ASME PTC 22-2014
(Revision of ASME PTC 22-2005)

Gas Turbines

Performance Test Codes

AN AMERICAN NATIONAL STANDARD

The American Society of
Mechanical Engineers

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The American Society of Mechanical Engineers
Two Park Avenue • New York, NY • 10016 USA

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This Code will be revised when the Society approves the issuance of a new edition.

ASME issues written replies to inquiries concerning interpretations of technical aspects of this Code. Interpretations are published on the Committee Web page and under go.asme.org/InterpsDatabase. Periodically certain actions of the ASME PTC Committee may be published as Cases. Cases are published on the ASME Web site under the PTC Committee Page at go.asme.org/PTCcommittee as they are issued.

Errata to codes and standards may be posted on the ASME Web site under the Committee Pages to provide corrections to incorrectly published items, or to correct typographical or grammatical errors in codes and standards. Such errata shall be used on the date posted.

The PTC Committee Page can be found at go.asme.org/PTCcommittee. There is an option available to automatically receive an e-mail notification when errata are posted to a particular code or standard. This option can be found on the appropriate Committee Page after selecting "Errata" in the "Publication Information" section.

The American Society of Mechanical Engineers
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NOTICE

All Performance Test Codes must adhere to the requirements of ASME PTC 1, General Instructions. The following information is based on that document and is included here for emphasis and for the convenience of the user of the Code. It is expected that the Code user is fully cognizant of Sections 1 and 3 of ASME PTC 1 and has read them prior to applying this Code.

ASME Performance Test Codes provide test procedures that yield results of the highest level of accuracy consistent with the best engineering knowledge and practice currently available. They were developed by balanced committees representing all concerned interests and specify procedures, instrumentation, equipment-operating requirements, calculation methods, and uncertainty analysis.

When tests are run in accordance with a Code, the test results themselves, without adjustment for uncertainty, yield the best available indication of the actual performance of the tested equipment. ASME Performance Test Codes do not specify means to compare those results to contractual guarantees. Therefore, it is recommended that the parties to a commercial test agree before starting the test and preferably before signing the contract on the method to be used for comparing the test results to the contractual guarantees. It is beyond the scope of any Code to determine or interpret how such comparisons shall be made.

FOREWORD

The original Performance Test Codes Committee No. 22 was established in 1945 to develop a test code on Gas Turbine Power Plants. This initial Code was published in 1953. Subsequent versions of the Code were published in 1966 and 1985, each time incorporating latest practices in accordance with the directives of PTC 1, General Instructions.

The 1997 version addressed for the first time the issue of measurement uncertainty, and also recognized the significant advances in gas turbine and instrumentation technologies.

The efforts on the 2005 version began during the publication period of the 1997 Code. Its objectives were to develop procedures for comparative (back-to-back, or before and after) testing and for determining exhaust flow and energy for heat recovery applications. The 2005 version incorporated these procedures, as well as updated calculations in many areas to reduce the uncertainty of the results.

Work on the current edition began in 2007. The key objectives of this revision were to correct errors and omissions, provide harmonization with other codes and standards, and provide clarification to the intent of the Code as a result of industry feedback and interpretations to the 2005 version. Some of the most significant changes included incorporating the methodology for determination of gas turbine exhaust energy, flow, and temperature into mandatory sections and a mandatory appendix when these performance results are part of the object of the Code. Similarly, when comparative performance is a test goal, the requirements and guidelines for comparative testing are included in mandatory sections of the Code. As a result of advances in instrumentation, Section 4 was revised to include additional flow metering technology. Section 7 on Test Uncertainty was revised to provide compliance with the methodology for determination of uncertainty used in the revised PTC 19.1, Test Uncertainty and incorporate the most current engineering analysis and experience.

This Code was approved and adopted as an American National Standard on June 9, 2014.

ASME PTC COMMITTEE
Performance Test Codes

(The following is the roster of the Committee at the time of approval of this Code.)

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CORRESPONDENCE WITH THE PTC COMMITTEE

General. ASME Codes are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Code may interact with the Committee by requesting interpretations, proposing revisions or a Case, and attending Committee meetings. Correspondence should be addressed to

Secretary, PTC Standards Committee
The American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990
http://go.asme.org/Inquiry

Proposing Revisions. Revisions are made periodically to the Code to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Code. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Code. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Code and the paragraph, figure, or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Code to which the proposed Case applies.

Interpretations. Upon request, the PTC Standards Committee will render an interpretation of any requirement of the Code. Interpretations can only be rendered in response to a written request sent to the Secretary of the PTC Standards Committee at go.asme.org/Inquiry.

The request for an interpretation should be clear and unambiguous. It is further recommended that the inquirer submit his/her request in the following format:

Subject:	Cite the applicable paragraph number(s) and the topic of the inquiry.
Edition:	Cite the applicable edition of the Code for which the interpretation is being requested.
Question:	Phrase the question as a request for an interpretation of a specific requirement suitable for general understanding and use, not as a request for an approval of a proprietary design or situation. The inquirer may also include any plans or drawings that are necessary to explain the question; however, they should not contain proprietary names or information.

Requests that are not in this format may be rewritten in the appropriate format by the Committee prior to being answered, which may inadvertently change the intent of the original request.

ASME procedures provide for reconsideration of any interpretation when or if additional information that might affect an interpretation is available. Further, persons aggrieved by an interpretation may appeal to the cognizant ASME Committee or Subcommittee. ASME does not "approve," "certify," "rate," or "endorse" any item, construction, proprietary device, or activity.

Attending Committee Meetings. The PTC Standards Committee and PTC Committees regularly hold meetings and/or telephone conferences that are open to the public. Persons wishing to attend any meeting and/or telephone conference should contact the Secretary of the PTC Committee. Future Committee meeting dates and locations can be found on the Committee Page at go.asme.org/PTCcommittee.

GAS TURBINES

Section 1
Object and Scope

1-1 OBJECT

This Test Code provides directions and rules for conduct and report of results of thermal performance tests for open cycle gas turbine power plants and gas turbine engines, hereafter referred to as *gas turbines*. The object is to determine the thermal performance of the gas turbine when operating at test conditions, and correcting these test results to Specified Reference Conditions. This Code provides explicit procedures for the determination of the following performance results:

(a) corrected power
(b) corrected heat rate (efficiency)
(c) corrected exhaust flow
(d) corrected exhaust energy
(e) corrected exhaust temperature

Tests may be designed to satisfy different goals, including absolute performance and comparative performance.

It is the intent of the Code to provide results with the highest level of accuracy consistent with the best engineering knowledge and practice in the gas turbine industry. In planning the test, an uncertainty analysis must demonstrate that the proposed instrumentation and measurement techniques meet the requirements of the Code.

1-2 SCOPE

This Code provides for the testing of gas turbines supplied with gaseous or liquid fuels (or solid fuels converted to liquid or gas prior to entrance to the gas turbine). Tests of gas turbines with emission control and/or power augmentation devices, such as injection fluids and inlet-conditioning, are included. It may be applied to gas turbines in combined cycle plants or with other heat recovery systems.

This Code provides for comparative (back-to-back) tests designed to verify performance differentials of the gas turbine, primarily for testing before and after modifications, uprates, or overhauls. Improvements to achieve additional performance may include application of advanced gas path components, modification of combustion system, control scheme changes, increased mass flow, and changes to the inlet and exhaust systems of the gas turbine.

The Code does not apply to the following:

(a) gas turbines where useful output is other than power to drive a generator or other load device.

(b) environmental compliance testing for gas turbines for stack emissions and sound levels. Procedures developed by regulatory agencies, ANSI, other ASME PTC Committees, or other equivalent standard, are available to govern the conduct of such testing.

(c) overall plant power and thermal efficiency of gas turbine combined cycle and cogeneration facilities. Refer to ASME PTC 46 or equivalent standard.

(d) absolute or comparative performance of specific components of the gas turbine.

(e) performance of auxiliary systems of the gas turbine power plant, such as inlet cooling devices, fuel gas booster compressors, etc.

(f) operational demonstration tests and reliability testing.

(g) itemized performance changes that are the result of multiple actions, such as modifications, repairs, or cleanings (i.e., compressor, inlet air filtration systems, etc.).

1-3 TEST UNCERTAINTY

1-3.1 Absolute Performance Test Uncertainty

For absolute performance tests, this Code establishes a limit for the uncertainty of each required measurement (parameter or variable), and also limits the variation of the critical parameters during the test. The test uncertainty is then calculated in accordance with the procedures defined herein and by ASME PTC 19.1. The procedures include establishing a Code Limit test uncertainty. Both pre- and post-test uncertainty calculations are required.

Users of this Code shall develop their own site- and equipment-specific uncertainty. The overall test uncertainty will be unique for each Code test because of the